THE MAYTOWN OCHRE SOURCE

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The mineralogy and elemental fingerprint of a well-defined ochre source near Maytown, north Queensland are described. Characteristics of the ochre were investigated via petrographic, XRD, SEM/EDXA, FTIR and PIXE/PIGME analyses. Potential archaeological implications of this source are briefly explored. □ *Ochre, sourcing, rock art, north Queensland, Australian prehistory.*

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Earth pigments (ochres) were, and in many places continue to be, commonly used by Aboriginal people to paint, draw, stencil or print on a variety of surfaces (e.g., wooden objects, cave walls, bodies). Ochres were sometimes obtained from distant places, at times measuring in the thousands of kilometres. This was especially the case with ochres of high repute, be it for their particularly high physical qualities or for their special Dreaming significance (e.g., Peterson & Lampert, 1985; Sagona, 1994). In this paper, we differentiate between a *source*, being a location of readily available raw material (not necessarily exploited), and a *quarry*, being a demonstrably exploited source.

Once characterised, well-defined ochre sources offer archaeologists the potential of provenancing ochre excavated from archaeological deposits. Once archaeological specimens are provenanced, prehistoric trade or exchange networks and systems of inter-regional interaction can be reconstructed. For such a program to succeed, however, elemental and/or mineralogical 'fingerprints' of specific sources need to be first established. To date, the characteristics of potential sources of ochre have been almost totally ignored (but see David et al., 1993; Sagona, 1994). This has resulted in a dearth of information fundamental to the sourcing of archaeological specimens. This paper thus aims to initiate a program of 'fingerprinting' ochre sources in northern Australia. So far, our efforts have concentrated on ochrous pebbles from creek and river beds. The boundaries of such sources tend to be ill-defined, although in north Queensland well-defined ochre sources and quarries are extremely rare. In this paper, we report one occurrence of a well-defined and highly localised ochre source from north Queensland, here referred to as the Maytown Source.

THE SOURCE

The Maytown source is located in the bed of the Palmer River, immediately west of the now abandoned town of Maytown, north Queensland (Limestone Creek 1:50,000 map sheet, edition 1-AAS, Grid Reference AC892287). The source is entirely submerged under water during the wet season, but totally exposed during the dry. It is an extremely localised and well defined outcrop of weak red to dark reddish gray pigment (dry Munsell 10R 4/2 to 2.5YR 4/2), measuring c.30 x 30 x 1.5m (Fig. 1). The source does not show any evidence of previous extraction, although prehistoric quarrying activity would be extremely difficult to detect given the friable nature of the ochre and the annual flooding of the outcrop in the Palmer River bed. No other ochrous outcrops have yet been noted nearby.

The ochre appears to be homogeneous to the naked eye. A large piece of ochre (c.20 x 10 x 5cm) and a few smaller pieces were detached by us from the block outcrop for mineralogical and elemental analyses. The results are presented below.

X-RAY DIFFRACTION (XRD)

A flake broken from a larger piece of the Maytown ochre source was pulverised and finely ground using an agate pestle and mortar. An XRD pattern (Laval University spectrum #3569) was obtained using a Siemens diffractometer equipped with a Copper anode (1.54184Kα X-rays) operated at 40kV and 20mA. Two theta scan

FIG. 1. The Maytown Source.

range was from 5 to 65 degrees at 10 degrees two theta/minute and a time count of 1.2 seconds.

The spectrum of the pigment is predominantly quartz with minor muscovite (Fig. 2).

Scanning Electron Microscope Energy Dispersive X-ray Analysis (SEM/EDXA)

SEM observations and analyses were made on two sub-sample flakes, mounted carbon discs and coated with Au-Pd, using a JEOL JSM-840A SEM with a germanium window and equipped with a Tracor Northern energy dispersive X-ray analytical system. Operating conditions were 15kV and 100µA with a working distance of 15mm.

A relatively uniform composition was measured across the broken pigment samples. Qualitative assessment of elements present include Si, O, Al, Fe and K (Fig. 3). There may also be a very slight trace of carbon-bearing mineral, but the very low peak could also reflect a slightly higher background. Secondary electron images of the fractured surfaces (Fig. 4) show a sub-parrallel arrangement of platy crystals, typical of a schist. The visual microscopic observations and the elemental compositions, when combined, indicate that the pigment is a ferruginised quartz-mica schist.

Fourier Transform Infrared Analysis (FTIR)

The infrared spectrum was recorded using a Perkin Elmer FTIR 2000 with a MTEC photoacoustic detector on a solid piece of ochre. The spectrum (Fig. 5) indicates a mica species with bands typical of muscovite or sericite. Small bands in the OH stretching region of the spectrum indicate small amounts of a clay mineral. A small

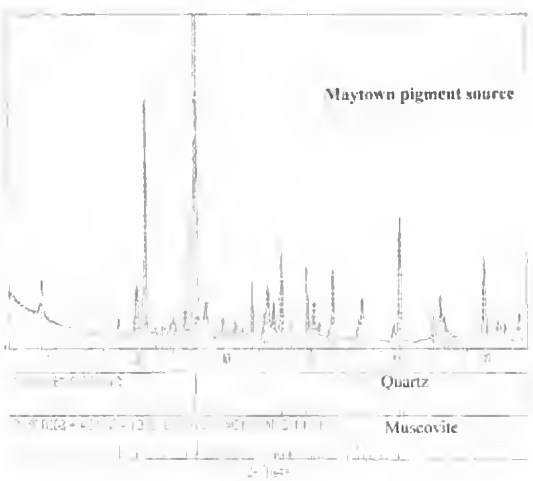

FIG. 2. XRD spectrum.

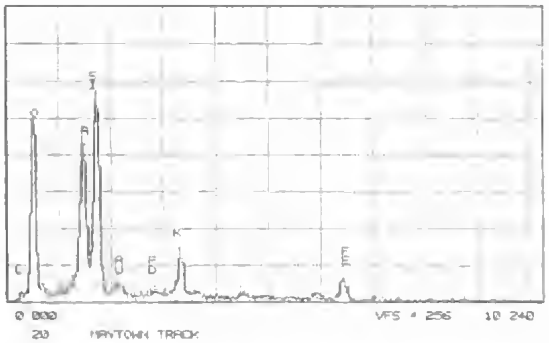

FIG. 3. SEM/EDXA spectrum.

band at 1430cm^{-1} indicates a carbonate in the sample.

PIXE/PIGME

The PIXE/PIGME results were recorded on the 2.5 Mev van der Graff accelerator facility at Lucas Heights. A pinhole filter was used to reduce the effects of high Fe concentrations. Seven samples were analysed in two separate runs (four samples in 1990 and three in 1994). The 1994 samples (1-3 in Table 1) are those used for infrared analysis. Raw results were calibrated against geological standards and calculated using the PIXAN package (Clayton, 1986). Quantitative assessment of 28 major and trace elements was made, and the results of 15 elements are given in Table 1. The presence of Ca, Ti and Na in minor amounts (1-4%) appears to be typical of ochres from this region (David et al., 1993). Fe is present in high amounts, as is to be expected for a red coloured material. Si and Al are also major elements. K is present as a major component; this is consistant with a muscovite-mica type mineralogy.

Multivariate (Average Linkeage Cluster) analysis undertaken on nearly 100 red ochre samples from northern Australia have linked the seven Maytown source samples presented here into a single cluster, separating out from all the other (non-Maytown source) samples. The implication is that, on elemental characteristics alone, the Maytown source is quite distinctive from the other known ochre sources of northern Australia.

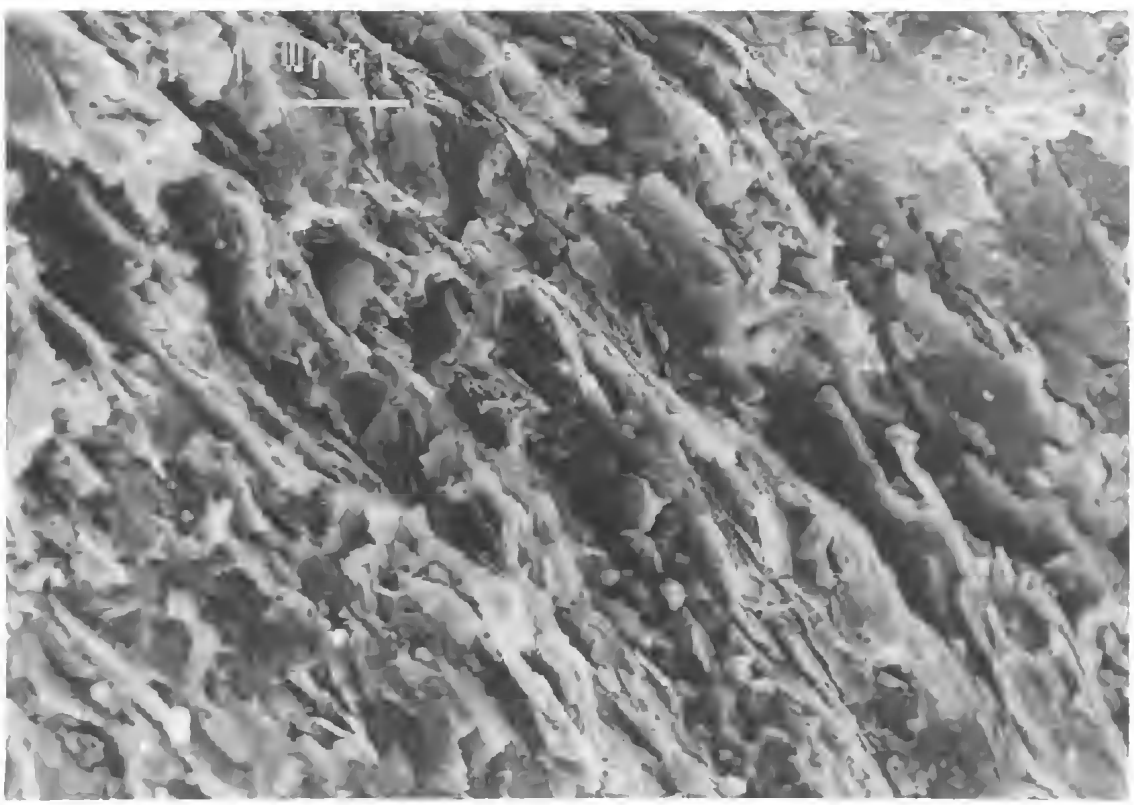

FIG. 4. SEM image. Scale= μm.

TABLE 1. Element concentrations determined by PIXE/PIGME analysis. All concentrations are mg/kg unless noted as weight percent.

No.	1	2	3	4	5	6	7
F	764.0	794.0	913.0	890.9	616.5	666.4	1005.5
Na	4505.0	3258.0	4234.0	4430.8	3680.7	4387.0	4194.4
Al(%)	8.1	8.5	8.9	9.0	7.4	7.0	9.9
Si(%)	32.7	29.0	33.5	41.3	39.5	43.3	37.5
K(%)	3.4	3.5	4.0	4.7	3.3	3.5	5.4
Ca	900	1100	1100	400	400	900	500
Ti(%)	0.5	0.5	0.5	0.5	0.6	0.5	0.6
Mn	993.0	376.0	488.0	72.8	142.9	61.4	712.5
Fe(%)	4.8	5.3	5.0	6.1	3.7	5.8	5.5
Ni	23.0	15.0	15.0	6.6	0.0	13.7	36.5
Cu	6.0	14.0	6.0	29.3	0.0	15.6	10.3
Zn	70.0	81.0	52.0	52.4	40.0	100.4	46.8
Rb	199.0	173.0	227.0	216.3	167.5	206.7	257.5
Sr	71.0	76.0	123.0	63.3	70.2	73.9	65.8
Zr	140.0	138.0	137.0	13.2	0.0	0.0	0.0

The results of these investigations will be presented elsewhere.

The Maytown ochre source, a ferruginised quartz-muscovite schist, is the first to be systematically described from north Queensland. Limited by a lack of comparative material, it is therefore too early to determine with any authority whether or not local cave paintings were made with this material. Nevertheless, preliminary mineralogical investigations of paintings from the Blue Figures, Cockatoo, Quinkans, Longtom and Mushroom Rock art sites near Laura (to the immediate north of the Maytown Source) have revealed similar, although not identical, mineralogical and SEM/EDXA features to the Maytown pigment source (Watchman et al., 1993). This does not prove that pigment samples from the Maytown Source were used in Laura paintings, but it does suggest that similar geological material in the Lower Proterozoic Hodgkinson Formation (de Keyser & Lucas, 1968) was used as a rock painting pigment. It also highlights the need for a detailed mapping of potential pigment sources across north Queensland. It is only under such a research program that definitive statements on the provenance of archaeological ochres will be warranted.

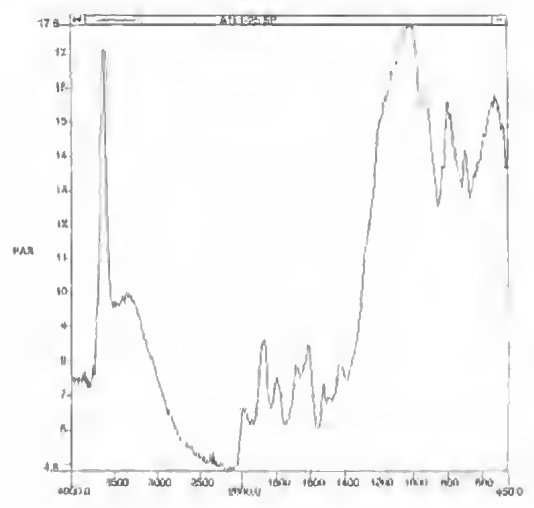

FIG. 5. Fourier Transform Infrared Photoacoustic (FTIR-PAS) Spectrum.

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